Census 2000 Testing,
Experimentation,
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Synthesis of Results from the Response Mode and Incentive Experiment

FINAL REPORT

This research paper reports the results of research and analysis undertaken by the U.S. Census Bureau. It is part of a broad program, the Census 2000 Testing, Experimentation, and Evaluation (TXE) Program, designed to assess Census 2000 and to inform 2010 Census planning. Findings from the Census 2000 TXE Program reports are integrated into topic reports that provide context and background for broader interpretation of results

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TABLE OF CONTENTS

– List of Appendices –

Table of Contents (continued)

– List of Tables –

– List of Figures –

EXECUTIVE SUMMARY

The Response Mode and Incentive Experiment investigated the impact of three computer-assisted data collection techniques – Computer-Assisted Telephone Interviewing, Internet, and Interactive Voice Response – on the response rate and data quality in Census 2000. Households participating in the study were randomly assigned to six panels and to a control group. The households in the six panels were given the choice of providing their Census 2000 data via the usual paper forms or by one of the alternate computer-mediated response modes. Half of the panels were offered an incentive, a telephone calling card good for 30 minutes of calls, for using the alternate response mode.

In addition, the experiment included a nonresponse component designed to assess the effects of a promised incentive and alternative response mode options on response among a sample of census households who failed to return their census forms by April 26, 2000. The intent of the nonresponse component was not to test incentives or response mode options as possible nonresponse conversion techniques for the census. Rather, the experiment was designed to test the effect of these factors on response among a group representing those who are traditionally difficult to enumerate.

A final component of the experiment involved interviewing households assigned to the Internet mode (both with and without the incentive) who opted to complete the traditional paper census form. The purpose of the interview was to determine why these households did not use the Internet.

Results from the initial mailout portion of the Response Mode and Incentive Experiment show that:

- **Computer-assisted Telephone Interviewing brought about a small but statistically significant improvement in the overall response rate.** It also had a low item nonresponse rate. However, in the context of this experiment, it entailed substantial cost for hardware, software, and programmer and interviewer labor.

- **The Internet mode yielded relatively high data quality.** The primary additional cost associated with this mode involved the development and maintenance of the software and hardware. The benefits of this data collection method may outweigh these costs.

- **The implications of this study are complex for the use of the Interactive Voice Response technology.** Data quality was the lowest for this mode. Respondents appeared to dislike lengthy surveys with this method and some respondent sub-groups (mixed race respondents and Hispanics) were more likely to report confusion with the task. Nonetheless, this mode is an appealing way to reach persons with limited literacy skills. The costs associated with this mode included the hardware, programming, speech recognition software, and telephone expenses.

- **The calling card was very effective in promoting the use of the alternative response mode.** However, rather than encouraging more households to participate, the incentive tended to redirect households that would have responded by mail to the alternate computer-mediated response mode. This effect may be partially attributable to the colorful inserts in the household mailing that directed attention to the calling card.

- **The impact of the calling card may not justify its cost.** In the Internet and computer-assisted telephone interviewing conditions, the incentive may have brought about an increase in responding via the alternate mode, but this increase was offset by decreases in responding by mail.

Results from the nonresponse component of the Response Mode and Incentive Experiment show that:

- **Computer-assisted telephone interviewing elicited the highest response from Census nonrespondents (7.8 percent) followed by the Interactive Voice Recognition Questionnaire (4.8 percent) and the Internet (3.7 percent).** This comparison is confounded by the fact that Internet access may be especially problematic for this target population.

- **Respondents to the Interactive Voice Response mode are significantly younger and reside in households with, on average, fewer people than both mail and computer-assisted telephone interview respondents.** Computer-assisted telephone interview respondents are disproportionately Black with more households residing in low coverage areas compared to Internet respondents.

- **The calling card incentive increased response to the alternative modes by 1.9 percent across all response modes.**

- **Person 1 in households receiving the incentive due to alternative response mode participation tended to be younger than Person 1 in households not receiving the incentive.**

- **Contrary to past research, the increase in response due to the incentive is not statistically different in areas with high concentrations of the Black and Hispanic populations and renters (1.9 percent) from other areas (2.0 percent).**

- **When total response to an experimental second mailing is considered, no significant incentive effect remains.** That is, when mail responses are included as respondents, the incentive group (13.8 percent) is no more likely to respond than the non-incentive group (13.2 percent). Similar to the initial mailout experiment, it appears that the incentive merely redirects responses that would have otherwise been obtained by mail to alternative modes.

- **Irrespective of the experimental treatments, around 13 percent participation was obtained from cases that did not initially return the questionnaire or returned the questionnaire late.** Replacement questionnaires were not included in the second mailing, implying that respondents who returned a mail form, around six to nine percent, used their original questionnaire mailed in March 2000.

Finally, results from the Internet Usage Survey indicate that:

- **Approximately 63 percent of the Internet Usage Survey sample reported having access to the Internet.** Thus, access does not appear to be a major reason why these census respondents did not opt to complete their census form via the Internet.

- **Nearly half of the Internet Usage Survey respondents reported they were unaware that the Internet was an option for completing their census forms.**

- **Among respondents who were aware of the Internet option, 35 percent reported that they believed the paper census form would be easier to complete.** Other reasons for not using the Internet included: no access to a computer, concerns about privacy, forgot the Internet was an option, and insufficient knowledge of the Internet.

- **Respondents reported that an incentive to complete the census via the Internet would have encouraged them to use this alternative mode.** About 41 percent of respondents who were not offered the incentive or were unaware of the offer said they would fill out their census form via the Internet if they were offered a 30 minute calling card. Another nine percent indicated they would do it for a 60 minute calling card, and an additional 12 percent would be willing if a 90 minute calling card was offered.

Based on the findings of the Response Mode and Incentive Experiment, the following recommendations are made:

- **The Internet is an attractive alternative data collection mode for the decennial census.** Although no formal cost/benefit analysis was completed, it seems likely that the cost of developing and supporting a web-based application for Census 2010 would be less than the costs associated with the data processing required for the paper forms that would be returned from households who would have been willing to provide their data via the Internet. As internet accessibility and usage continues to expand, additional savings could be realized.

- **The use of an incentive was an effective means of promoting the use of the alternative response modes.** Comparisons between the incentive and no-incentive conditions in the initial mailout experiment reveal that the incentive was associated with three to four-fold increases in the rate of using the alternative mode. However, some of this effect may be attributable to the use of the insert which drew the respondent's

attention to the availability of the alternative mode.

- **Data quality was improved for the computer-assisted telephone interviewing mode (as compared with mail).** However, this mode entails substantial cost investments for hardware, software, and programmer and interviewer time.

- **Without significant improvements in the voice-user interface, the Interactive Voice Response technology is probably not a viable alternative for Census 2010.** Data quality was the lowest of all the response modes. This occurred primarily as a result of respondents hanging up before they had provided complete data. When this occurred, even the partial information that had been provided was deleted, resulting in a significant loss of data. In addition, the costs associated with developing this type of system are sizeable.

- **The use of alternative response modes does not increase overall response rates to the census.** Rather, it shifts households who would respond via the paper census to the other modes. This pattern holds true for groups who are traditionally difficult to enumerate in the census, as evidenced by the results of the nonresponse component of this experiment.

Results from the Response Mode and Incentive Experiment suggest several areas worthy of future research:

- **Research is needed to determine the best ways to present the response mode alternatives, as it appears that some respondents assigned to the no-incentive treatments did not read the letter that accompanied their paper census form informing them of the alternative mode option.** The use of a colorful mailing insert, irrespective of whether an incentive is offered may be enough to attract respondents to an alternative census mode. However, this information cannot be determined from the data obtained from this experiment.

- **Research is needed to determine whether recent advances in speech recognition software can improve the voice user interface to increase data quality and eliminate some of the dissatisfaction voiced by respondents who answered the Interactive Voice Recognition Questionnaire satisfaction survey.**

- **The choice of incentive should be revisited.** Based on the number of respondents who never used their calling card once they were activated, it appears that the card may not have been a powerful incentive.

1. INTRODUCTION

The potential benefits of using Internet, Computer-assisted Telephone Interviewing (CATI), and/or Interactive Voice Response (IVR) surveys for the census can only be realized if large numbers of respondents are willing to answer survey questions using these computer-assisted data collection methods. The objective of the Response Mode and Incentive Experiment (RMIE) was to investigate the effect of these technologies in Census 2000.

The specific goals of the RMIE study were:

- To assess the public's willingness to provide census data using these computer-mediated data collection methods;
- To evaluate the quality of the data collected using these methods; and
- To study the ability of incentives, in the form of telephone calling cards, to promote the use of these computer-mediated methods.

1.1 Experiment Components

The RMIE has three basic components. The first is the initial mailout. Census 2000 forms were delivered to all households in the United States beginning in mid-March of 2000. A sample of the households that received the short form were randomly selected, prior to the mailout, for the RMIE. This sample was stratified into one of two areas based on the geographical location of the household.

Some of the households in the random sample served as the Census Control Group (CCG); each of these households received a form and letter identical to those used in the national Census 2000 mailing. The rest of the households in the sample received special instructions, giving them the choice of providing their census data either by filling out the paper form, or by using a computer-assisted method:

- One subsample of the households was given the option of providing their census data via a CATI.
- A second subsample was given the option of providing their census data via an IVR system.
- A third subsample was given the choice of providing their data on a web-based survey.

Half of the households in each of these three experimental conditions were offered telephone calling cards as an incentive to use the computer-assisted method to report their census data.

The second component of the RMIE was an operation to follow up with the nonrespondents of

the CCG. Households in the CCG that failed to mail back their census forms—that is, the nonrespondents to the initial mailout—were given the opportunity to provide their census data using one of the three computer-assisted methods. Half of these nonrespondents were offered the calling card incentive to use a computer-assisted method. Thus, the design of this nonresponse (NR) phase of the RMIE was very similar to the design of the initial mailout component. Appendix A provides a layout of the RMIE design for these first two components (sample sizes are shown in parentheses).

The third component of the RMIE was an Internet Usage Survey (IUS). This telephone survey involved a sample of the households that were offered the opportunity to fill out the Internet version of the census short form in the initial mailout but either mailed in their data on the paper form or called the operator assistance (OA) number and provided their census data to a telephone interviewer. The Internet usage survey explored the reasons why these households chose not to provide their information using the web-based survey.

The advance letter and reminder postcard to RMIE households were included in the nationwide mailing. RMIE households that requested a special language form were excluded from the RMIE data analysis.

1.2 Research Questions to be Answered

The RMIE was designed to address the following research questions:

- What effect does an incentive have on census response behaviors (both overall response as well as item response)?
- What effect does an alternative response mode have on census participation rates (both overall response as well as item response)?
- What effect does an incentive have on census response by alternative electronic response modes for typical census nonrespondents?
- What effect does an incentive have on census participation across the various response mode options and subpopulations that historically differ with regard to census participation?
- What reasons do respondents give for choosing to provide their census information using the paper form rather than via the Internet?

A fuller discussion of the goals and objectives of the RMIE can be found in the Program Master Plan prepared by Malakhoff and Sanders (2000).

The RMIE was appropriately designed to allow the researchers to determine the independent effect of an incentive and an alternative response mode on participation rates and data quality.

Assigning nonrespondents to the CCG to treatment groups allowed for a further understanding of the role that incentives and alternative response modes play in persuading traditionally reluctant census households to participate. Finally, the inclusion of the IUS allows for a fuller understanding of the barriers, both actual and perceived, that must be overcome to make the Internet a viable option for the next census. Given the likely cost reductions that could be realized in fielding the census if a significant proportion of households responded via the Internet, the results of the IUS are especially important.

2. METHODOLOGY

2.1 Research Plan

A total of 35,377 households were randomly selected for this study from the Decennial Master Address File (DMAF) developed for Census 2000. All of these households were from the 94.3 million households in mailout/mailback areas (Households that were selected for the Accuracy and Coverage Evaluation initial and final samples were not eligible for selection.). All households selected were scheduled to receive the short form.

Of the households selected for this study, 15,738 were randomly dispersed among six panels in a three by two, fully factorial design to form the initial mailout component of the RMIE experiment. The first factor, response mode, had three levels: CATI, IVR, and Internet. The households were given the choice of providing their census data either via U.S. mail on the usual paper forms, or via their assigned computer-assisted response mode.

The second factor, the incentive, had two levels: incentive and no incentive. Households in the incentive condition were rewarded for using a computer-assisted response mode to provide their census data, while those in the no-incentive condition were not. The reward was a telephone calling card.

The six panels and the number of households assigned to each were as follows:

Panel 1: CATI with no incentive	2,621
Panel 2: IVR with no incentive	2,621
Panel 3: Internet with no incentive	2,627
Panel 4: CATI with incentive	2,622
Panel 5: IVR with incentive	2,623
Panel 6: Internet with incentive	2,624

2.1.1 *Mailings*

The Census Bureau mailed a short form for Census 2000 and a cover letter to each household in

this study at the same time census forms were mailed to all households in the nation. Appendix B contains copies of the RMIE mailings. The cover letter explained that the household could provide census data in either of two ways. First, the household could mail in the data in the usual way, using the paper form. Alternatively, the household could use a computer-assisted method. The cover letters to panels 1 and 4 explained that the household could provide data over the telephone by dialing a toll-free number. The cover letters to panels 2 and 5 also explained that the household could provide data by telephone by calling a toll-free number. Neither letter mentioned how the data would be collected once the household placed the call. The cover letters to panels 3 and 6 explained that the household could provide data via a web-based questionnaire available at *www.2000.census.gov.*

The mailings to panels 4, 5, and 6 (the incentive panels) contained an insert, printed in color on heavy stock paper. The calling card was attached to this insert. The cover letter and insert explained that if the household provided its census data using the computer-assisted method, the calling card would be activated, giving it a value worth 30 minutes of domestic calls.

The paper census forms sent to the households in all six panels provided a toll-free number for any questions. This number was different from the toll-free help line number that appeared on the standard Census 2000 forms received by households that were not assigned to the RMIE. This source of help and information was called "Operator Assistance" or simply "OA." Operators were available at that number to answer questions both about this study and about Census 2000 generally.

Mailed questionnaires were returned to the Jeffersonville Data Capture Center (DCC) at the National Processing Center (NPC). At the initial barcode reading, these questionnaires were identified and automatically sorted to the special data processing unit in NPC. Members of this unit were responsible for keying the census data directly from the paper forms. This differs from the method of data capture used for the regular census forms which employs image data capture.

2.1.2 *Census Control Group*

The remaining 19,639 households that were selected for this study comprised the Census Control Group (CCG). The CCG received mailings that contained a cover letter and a census short form. The mailings did not offer the CCG households the opportunity to provide census data using a computer-assisted response mode, nor did the mailings offer any type of incentive. The CCG served as a group against which the six panels in this study could be compared. In addition, households in the CCG that failed to provide their census data were involved in the second phase of the RMIE; the nonresponse component. Of the CCG, a total of 6,130 households failed to return their census form by April 26, 2000 and thus comprised the sample for the nonresponse component of the RMIE. These households were randomly assigned to panels 7A - 9A and panels 7B - 9B as shown in Appendix A. A second mailed package was sent to each of these households. These households had the option of answering Census 2000 via the standard paper questionnaire originally sent to the household; however, replacement questionnaires were not included in this second mailing and calling cards were not activated for households that returned

paper questionnaires.

Because the households in the CCG that failed to provide their census data were included in the nonresponse component, census forms for all CCG households listed the special OA number for RMIE rather than the standard toll-free assistance number printed on the Census 2000 short forms. Except for the OA telephone number, the mailings received by the CCG were identical to the official Census 2000 short form and cover letter. When CCG households had questions about the nonresponse phase and called the RMIE OA number, they reached an operator who was knowledgeable both about RMIE and about Census 2000 generally. As a courtesy, these operators could also collect census data if callers specifically requested to provide their information during the call.

2.1.3 *Stratification*

Each household selected for this study was classified as being from one of two strata: a low coverage area (LCA) or high coverage area (HCA). The LCA was comprised of census tracts with high concentrations of non-White residents and renters, two groups associated with high nonresponse rates. About 19.3 percent of the households in the DMAF in mailout/mailback areas are in the LCA; the HCA consists of the remaining households. In RMIE, households were proportionately selected from the two strata; just under one-fifth of the households in each panel and in the CCG were in the LCA stratum.

2.1.4 *Interactive Voice Recognition Questionnaire*

Only households assigned to panels 2 and 5 were informed of the IVR system telephone number in the initial mailout phase. Therefore, calls to the IVR system came only from households assigned to those two panels. The protocol for the IVR Questionnaire is included as Appendix C. The IVR Questionnaire was available to receive calls 24 hours a day.

The IVR Questionnaire closely followed the paper Census 2000 short form. However, unlike the paper census short form, the IVR Questionnaire allowed the collection of information about all members of a household, no matter how many there were. In contrast, the paper short form asked for information about only six persons in the household; it collected only the first and last names of the seventh through the twelfth persons, and no information at all for any persons beyond the twelfth.

The respondent answered nearly all questions in the IVR Questionnaire by speaking. The exceptions were the questions asking for the household's telephone number, the 22-digit census identification number, and the ten-digit calling card number (for panel 5 only). The respondents provided these data by pressing the touch-tone keys on their telephones. However, respondents who were not using a telephone with touch-tone keys provided this information verbally.

Immediately after respondents entered their 22-digit census identification numbers, the system determined whether the respondents had called the system previously. If a respondent had called

earlier, the system transferred the call to a CATI operator who collected any updated information from the respondent. The IVR system also transferred a call to a CATI operator if the respondent did any of the following:

- Failed to provide the 22-digit census ID when asked;
- Attempted to enter the census ID with a pulse telephone;
- Entered a census ID that was not in the databases for panels 2 or 5; or
- Indicated he/she was unable to work with the system properly

The CATI operator helped the caller find the correct 22-digit number and then collected the caller's census data.

When the speech recognition software attempted to recognize an utterance, it returned a confidence level associated with the recognition attempt. The level was expressed as a percentage, generally between 50 and 100. Recognition attempts with high confidence levels were more certain than attempts with low confidence levels.

If the software returned a confidence level under 70 percent in an attempt to recognize a "yes" or a "no" response, the system repeated the question. If the software still could not adequately recognize the response in this second attempt, the system transferred the call to a CATI operator, who administered the questionnaire. If no CATI operator was available at the time that the call was transferred, or if the transfer occurred after CATI working hours, the respondent heard a recorded message, left a name and telephone number, and received a call from a CATI operator later.

Some questions in the IVR Questionnaire, such as "Please tell us the month, day and year this person was born" required spoken responses that were more complex than a simple "yes" or "no." The system was not programmed to recognize these responses in "real time." Instead, the system recorded these responses so they could be transcribed soon afterward. The CATI operators transcribed these recorded responses during periods when they were not taking CATI calls.

At the end of the IVR Questionnaire, the respondents were given the opportunity to change any of their responses to any question. The transcriptionists listened to these changes and updated the data accordingly.

The IVR Questionnaire concluded with a set of questions to assess the respondent's satisfaction with the data collection method. These questions are summarized in Appendix D. In addition, timing data from the IVR Questionnaire were also retained for analysis. These data included the total amount of time required for the household to complete the IVR Questionnaire and the mean

time required to answer individual survey items.[1]

2.1.5 *Computer-Assisted Telephone Interview*

Persons from households that were selected for this study could reach a CATI operator in three ways:

- Calls to the IVR system were transferred to a CATI operator when the speech recognizer could not adequately recognize the respondent's responses to certain questions, or when the respondent entered a census identification number that was invalid or that belonged to a household that had already provided data.

- Households in panels 1 and 4 could dial the toll-free number to reach a CATI operator.

- Respondents in households in any panel could call the OA telephone line and offer to provide their data. Even though the OA number was offered primarily to help respondents with questions about this study or about the census generally, some respondents did call the OA number and ask to provide their census data. The OA operator transferred these calls to a CATI operator who collected the data regardless of panel assignment.

Callers heard a recorded message if they reached CATI during the late night or early morning or when all operators were unavailable. The message asked the callers to leave their names, telephone numbers, and the times that they might be available for a return call. A CATI operator later called the respondent to collect the census data.

At the start of the interviews, the CATI operators first ascertained whether the caller could speak English. If the caller could speak only Spanish, the operator transferred the call to a bilingual operator. If a respondent who spoke neither English nor Spanish called, the CATI operator could not collect any data. Since no communication was possible with these few callers, they were not considered respondents, and had no follow-up contact. If the caller could speak English, the operator began the interview by asking the caller to read the 22-digit census identification number from the mailing label. The operator administered the CATI interview after verifying that the identification number was from a household in this study. The content of the CATI interview closely followed the content of the Census 2000 short form. However, like the IVR Questionnaire, the CATI interview collected complete information about all persons in the household, no matter how many persons lived there. The protocol for the CATI interview is included as Appendix E.

2.1.6 *Internet Questionnaire*

[1]This time includes the time required for the system to play the question, the respondent to answer, two seconds to determine if the response is completed, and the speech recognition software to compute the response.

Census Bureau staff developed and provided the Internet-based questionnaire for the RMIE. Respondents answered multiple-choice questions in the questionnaire by clicking the appropriate radio buttons and checkboxes. They answered text-entry questions by typing their answers into response fields. The questionnaire screens were designed to resemble the short form paper questionnaire. The screens were not programmed with any branching logic or data validity checks. The Internet survey was available 24 hours a day. A printout of the survey appears in Appendix F.

2.1.7 *Internet Usage Survey*

The sample for the IUS was selected from those respondents in the internet panels of the RMIE who responded via mail or CATI[2] (through a phone transfer from OA). The frame from which the IUS sample was drawn included 293 households from panel 3 (internet, no incentive) and 277 households from panel 6 (internet with incentive). Since the original RMIE sample was selected with proportional allocation to stratum, it was anticipated that the IUS sample would be selected in the same manner. However, this selection methodology would have resulted in a very small sample size in the LCA strata due to nonresponse to the original mailing. Therefore, systematic sampling using equal allocation was conducted. The resulting sample included 318 cases in the HCA and 252 in the LCA. The IUS Questionnaire is included in Appendix G.

3. LIMITATIONS

As can happen in even the most carefully designed experiments, technical problems occurred over the course of the RMIE which bear mentioning here. The most significant of these were problems that affected the representativeness of the sample in the IVR panels (panels 2 and 5):

- When the IVR system first began accepting calls, a software problem in a lookup routine caused the system to inaccurately classify all of the callers as ones who had called before. The system therefore failed to administer the IVR Questionnaire and instead directed the calls inappropriately to the CATI operators immediately after the respondents entered their census identification numbers. This problem began with the first call to the IVR system and was resolved within just a few days. The first 115 calls to the IVR system (110 from panel 5 and five from panel 2) were affected.

- Once analysis of the data began, a serious problem was discovered. The response rate for panel 2 (IVR - no incentive) appeared to be very low. This inexplicable effect dwarfed all other observed effects and appeared to be an artifact of some error. Moreover, the proportion of mailings returned as Undeliverable As Addressed (UAA) was much lower

[2]Only seven CATI interviews were received in panels 3 and 6. These cases were selected into this sample with certainty.

for panel 2 than for any other panel. Further investigation revealed an apparent problem with the mailout for panel 2. With very few exceptions, no responses were received, nor were any mailings returned UAA, for panel 2 mailings to households in Missouri, Kansas, Nebraska, Louisiana, and Arkansas (the five states whose ZIP Codes start with 630 to 729), Hawaii, Oregon, Washington, and Alaska (the four states whose ZIP Codes start with 967 to 999), and ZIP Codes 39301 to 39648, 60202 to 60490, and 95608 to 95833. Similar problems were not detected for any other panel. The Census Bureau investigated this situation and found that some responses did in fact come in from households in these areas, but they arrived too late to be counted. Apparently, the mailout to these areas was either delayed or not sent, preventing the affected households from responding before the cutoff date.

- For panels 1 and 3, the proportion of UAA returns was more than two times higher for the state of Indiana than for any other state. In panel 1, Indiana had ten responding households, six nonresponding households, and 51 UAAs. In panel 3, Indiana had 13 responding households, no nonresponding households, and 55 UAAs. These UAA rates were by far the highest observed for any state in any panel. The UAA rate for the entire nation for panels 1 and 3 were respectively 10.5 and 11.0 percent. For Indiana alone the rates were respectively 76.1 and 80.9 percent.

The data were examined after removing all data from Indiana, Missouri, Kansas, Nebraska, Louisiana, Arkansas, Hawaii, Oregon, Washington, and Alaska, and ZIP Codes 39301 to 39648, 60202 to 60490, and 95608 to 95833. Chi square analysis revealed that the UAA rate differed among the six panels, even with these areas excluded (chi square = 10.13, df = 5, $p < 0.073$). Further tests revealed that this effect was entirely attributable to panel 2. The UAA rate for panel 2 was significantly lower than the rate for all the other panels (chi square = 7.62, df = 1, $p < 0.006$). No such significant effect was found for any other panel. Thus, even without the ten problematic states and the three problematic ZIP Code areas, the UAA rate for panel 2 was significantly depressed. This finding suggests that problems may still exist with the mailout for panel 2, even after the problematic states and ZIP Code areas are eliminated.

Based on these findings, the Census Bureau decided that two sets of analyses would be completed. ***Method 1*** involved analyzing data for only four of the six panels; panel 2 is excluded because of the mailout problems, and panel 5, the other IVR panel, is also be excluded to maintain a balanced, factorial design. All households in the remaining four panels were included in this analysis. The problem for Indiana in panels 1 and 3 is ignored. Insomuch as the Indiana problem involves UAA rates, not nonresponse rates, the impact of the problem on the response rates should be relatively minor.

Method 2 involved analyzing the data from all six panels. However, households from the ten problematic states and the three problematic ZIP Code ranges are excluded from the analyses. The assumption underlying this analysis is that data errors are eliminated by excluding these households. That assumption may not be correct; the depressed UAA rate for panel 2 suggests that problems may still exist even when the ten states and three ZIP Code areas are eliminated.

These analyses do not involve a truly national sample, since so much of the country is excluded from the sample. Thus, these results should not be generalized to the entire nation.

4. MAJOR FINDINGS

As noted in Section 3, several technical problems created limitations in the way the RMIE could be analyzed and interpreted. As a result, a decision was made to analyze the data in two different ways. One of the two approaches, **Method 1**, restricted the usable data to only that collected by the CATI or Internet modes. In contrast, analyses completed using **Method 2** allows all three response modes to be compared, though not for a sample that can be generalized to the entire nation. As the response mode is a critical component of the RMIE the results of this sub-national analysis are presented in this report. The interested reader can review the analyses completed using **Method 1** in the report entitled, *Response Mode and Incentive Experiment for Census 2000* (Westat, 2002).

Throughout this section two different response rates will be discussed. These two rates are computed as follows:

- The first computation considers all responses, regardless of the response mode. This includes responses using the paper form and any responses using the Internet or CATI. The response rates calculated this way are called the Overall Response Rates (ORR).

- The second computation considers only the alternative computer-mediated response modes that were offered in the mailings to the respective panels. Thus, the response rates for panels 1 and 4 include only those cases that responded via CATI. Similarly, the response rates for panels 3 and 6 include only those cases that responded via the Internet. The response rates calculated in this manner are called the Assigned Mode Response Rates (AMRR).

With either method, households were considered nonrespondents if they failed to respond at all, or if they provided data with too many omissions to meet the Census 2000 criteria for a complete response.

4.1 Effect of the Incentive on Response Rates – Initial Mailout Component

4.1.1 *Overall Response Rates*

The ORR of the no-incentive panels (72.55 percent) and the incentive panels (71.01 percent)

were not significantly different (chi square = 2.49, df = 1, n.s.).[3]

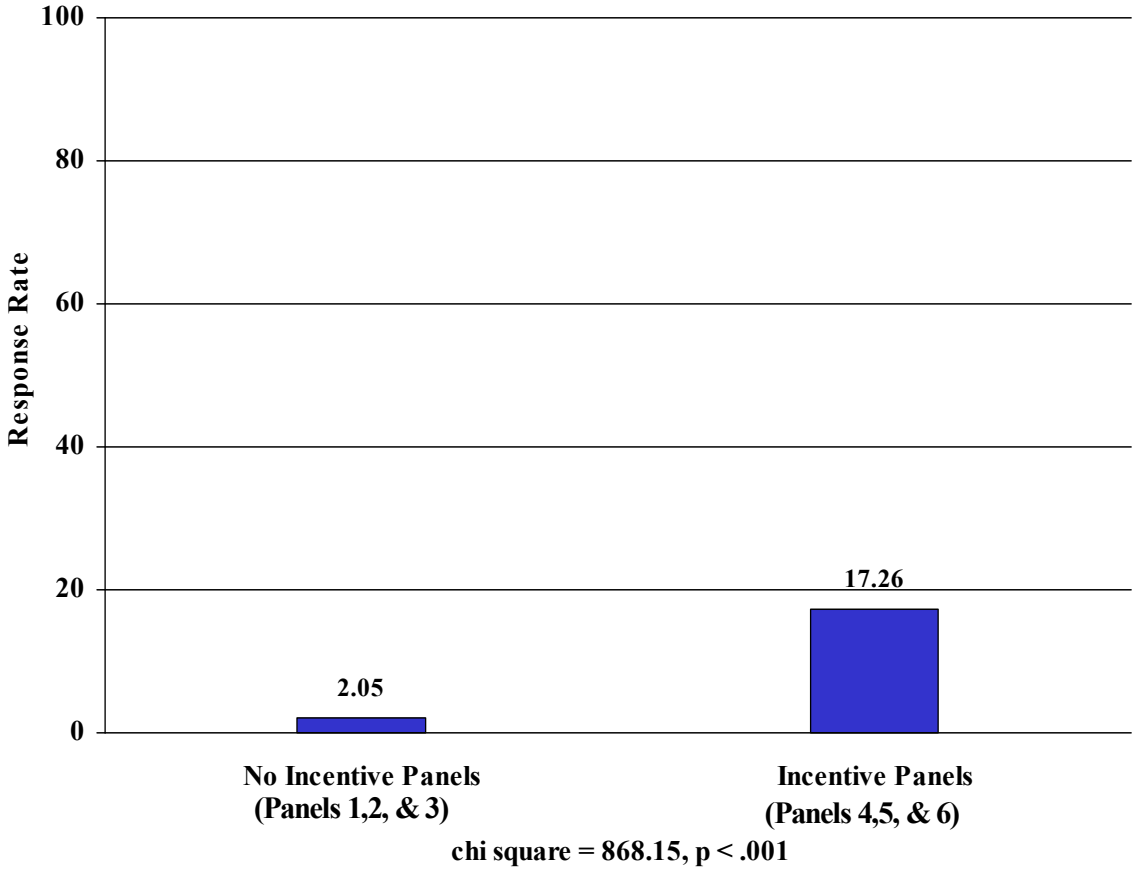
A logistic regression analysis was carried out to reveal any significant interactions between the incentive and the two other factors—response mode and coverage area. The results showed that the incentive factor did not attain statistical significance either by itself or in any interaction with the other factors.

4.1.2 *Assigned Mode Response Rate*

Figure 1 reveals that the incentive was associated with a large increase in the AMRR.

[3]At the time this report was prepared detailed response rate data for the high coverage and low coverage areas were not available.

Figure 1. Assigned Mode Response Rate: Combined Panels



A logistic regression analysis revealed a significant ($p < .001$) interaction between the incentive factor and the response mode factor. The difference between the incentive and no-incentive conditions was greater for the IVR and CATI response modes than it was for the Internet response mode.

Chi square analyses were carried out to illustrate the manner in which the incentive affected the AMRR. The results show that the AMRR in the incentive households were significantly ($p<.001$) higher than those in the no-incentive households, regardless of whether the households were in the CATI, IVR, or Internet response mode conditions. The AMRR increased from 1.4 to 17.9 percent for CATI; from 0.8 to 18.0 for the IVR, and from 4.0 to 15.9 for the Internet. Based on the logistic regression, this difference between the incentive and no incentive condition was larger for the CATI and IVR conditions than it was for the Internet condition.

The logistic regression also revealed a significant interaction between the incentive factor and

the coverage area factor. The difference between the incentive and no-incentive conditions was greater in the high coverage area than in the low coverage area. However, the incentive increased the AMRR, regardless of whether the households were in the high or low coverage area (from 2.1 to 19.2 percent for the HCA and from 1.7 to 9.8 for the LCA).

4.1.3 *Summary of Results for the Effect of the Incentive*

The effect of the incentive in the analyses involving all six panels and a sub-national sample can be summarized as follows:

- The incentive offered to the households for responding via an alternative, computer-mediated response mode had no significant effects on the ORR.

- The incentive increased the likelihood that the households would choose the alternative response mode.

- The incentive increased the AMRR most for the IVR and CATI response modes, and least for the Internet response mode.

- The incentive increased the AMRR more for the high coverage area than for the low coverage area.

One finding regarding the **choice** of incentive is of interest as well. Although the incentive increased reporting via the alternative modes, a large number of respondents never (or least not within seven months) used the calling card once it was activated. Of the 862 cards that were activated and for which data were available, a third had not been used. An additional 38 percent had been partially used, and about 28 percent had been fully used.

4.2 Effect of the Response Mode on Response Rates

4.2.1 *Overall Response Rates*

The ORR for the CATI panels (72.33 percent), IVR panels (70.67 percent) and Internet panels (72.35 percent) were not significantly different (chi square = 4.32, df = 2, n.s.).

The logistic regression analysis described in Section 4.1.1 also showed a significant interaction between the response mode factor and the coverage area factor. Respondents in the high coverage area were more likely to use CATI than the Internet. Chi square analyses were run to further illustrate the relationship between the response mode factor and the coverage area factor. The results suggested that the overall response rates differed among the three response mode conditions in the high coverage area (chi square = 7.05, df = 2, $p < .03$) but not in the low coverage area (chi square = 2.30, df = 2, n.s.). For high coverage area households, the overall response rate was lower in the IVR condition (73.6 percent) than in either the CATI condition

(76.2 percent, chi square = 6.23, df = 1, $p < .02$), or the Internet condition (75.4 percent, chi square = 3.21, df = 1, $p < .08$). No significant difference was found in the high coverage area households between the overall response rates in the CATI and Internet conditions (76.2 percent and 75.4 percent respectively, chi square = 0.64, df = 1, n.s.).

A logistic regression analysis was run that included the CATI no-incentive panel, the IVR no-incentive panel, the Internet no-incentive panel, and the CCG. The outcome variable was a response indicator. The predictor variables were the response mode, the coverage area, and all of the interaction terms. None of the interaction terms was statistically significant.

To further illustrate the pattern across response modes, chi square analyses compared the overall response rates of the CCG (71.1 percent) with those of the CATI no-incentive (72.33 percent), IVR no-incentive (70.67 percent), and Internet no-incentive (72.35 percent) panels. The overall response rate of the CCG was lower than that of the CATI no-incentive panel (chi square = 2.89, df = 1, $p < .09$), and the Internet no-incentive panel (chi square = 4.29, $p < .04$). The overall response rates of the CCG and the IVR no-incentive panel did not differ (chi square = 0.26, df = 1, n.s.).

4.2.2 *Effect of the Response Mode on the Assigned Mode Response Rate*

A three by two chi square test compared the AMRR of the CATI panels (9.65 percent), IVR panels (9.30 percent) and Internet panels (10.0 percent). The differences were not significantly different (chi square = 1.53, df = 2, n.s.).

As noted in Section 4.1.2, a logistic regression analysis revealed a significant interaction between the incentive factor and the response mode factor. This interaction suggests that the incentive increased the AMRR in the CATI and IVR conditions more than in the Internet condition. The results of a chi square analysis suggest that in the no-incentive condition, the Internet panel had the *greatest* AMRR (versus the CATI panel, chi square = 27.09, df = 1, $p < .001$; versus the IVR panel, chi square = 61.01, df = 1, $p < .001$). The AMRR of the CATI and IVR Questionnaire panels did not differ (chi square = 2.64, df = 1, n.s.).

For the incentive condition, Internet panel had the *lowest* AMRR (versus the CATI panel, chi square = 4.77, $p < .03$; versus the IVR Questionnaire panel, chi square = 2.98, $p < .09$). Again the AMRR of the CATI and IVR panels did not differ (chi square = 0.00, df = 1, n.s.).

4.2.3 *Summary of Results for the Effect of the Response Mode*

The effect of the response mode in the analyses involving all six panels and a sub-national sample can be summarized as follows:

- The ORR did not differ across the CATI, IVR, and Internet conditions.

- In the high coverage area, the ORR in the IVR condition was lower than that for the CATI or Internet conditions.

- The CATI no-incentive and the Internet no-incentive panels had a higher ORR than the CCG.

- The CCG's ORR was not significantly different from that of the IVR no-incentive panel.

- In the no-incentive condition, the Internet panel had the *greatest* AMRR.

- In the incentive condition, the Internet panel had the *lowest* AMRR.

4.3 Item Nonresponse Rates by Mode of Response

The highest item nonresponse rates occurred when the data were collected using the IVR Questionnaire, up to 11.8 percent for the race of Person 1 in the household, and nearly that high for age and date of birth (10.0 percent and 10.5 percent respectively). Much lower rates occurred when the data were collected by the other modes. Among the other modes, the mail had the highest item nonresponse rate, with the Internet and CATI having the lowest rates.

The amount of missing data for the IVR Questionnaire has important implications for the feasibility of this mode for the decennial census. A large proportion of the missing data was due to IVR respondents hanging up the telephone before the end of the interview. Most of these hang-ups occurred early in the interview. Some comments from respondents indicated impatience with the pace of the interview. This reaction may have been exacerbated by the type of information that was collected at the beginning of the interview, when the respondents were asked to enter their 22-digit identification numbers and telephone numbers with touch-tone buttons, and to say and spell the names of everyone in the household. These tasks, along with the speed with which the questions were administered, may have played a role in the respondents' decision to terminate the interview prematurely.

Some of the missing data in the IVR mode may be attributable to problems respondents encountered providing data within the time constraints allotted by the computer program. The system was programmed to repeat the question when it encountered two seconds of silence. Even given this repetition, respondents sometimes could not report the information for some items. Future IVR questionnaires may need to give the respondents more time to begin answering before it repeats the question. A longer wait time has relatively little cost (e.g., it does not increase the length of time to fill out the questionnaire for those that provide answers right away) and could result in capturing data from some of the respondents who, for whatever reason, could not initiate their answers within two seconds.

4.4 Results from the IVR Questionnaire Satisfaction Survey

Briefly, the results from the IVR Questionnaire Satisfaction Survey indicate the following:

- Hispanic respondents tended to spend more time per item than others. Respondents from households with more than one Hispanic member tended to have relatively long calls and found the questionnaire more confusing.

- Female respondents tended to give the system higher overall satisfaction ratings.

- Older respondents tended to give the system higher overall satisfaction ratings and to find that the IVR Questionnaire afforded the appropriate amount of time to answer.

- White respondents tended not to find the IVR Questionnaire confusing, and to spend less time answering the individual items. Black respondents tended to give the system higher overall satisfaction ratings. However, respondents who identified themselves with a race other than white or black tended to find the IVR Questionnaire to be confusing. Racial complexity of the household also affected how respondents rated the IVR Questionnaire. Respondents in mixed race households tended to find the IVR Questionnaire confusing and to have longer calls.

4.5 Results from the Nonresponse Component of the RMIE

As described earlier, the nonresponse component of the RMIE involved assigning the CCG nonrespondents to one of six treatment groups parallel to the six panels included in the main RMIE (refer back to Appendix A). This nonresponse study was not conducted as a means to test the utility of including nonresponse conversion incentives for the 2010 census. Rather, the goal was to test the effect of an incentive and alternative response modes as a means to improve response from groups who are traditionally difficult to enumerate.

With regard to the effect of the alternative modes on response, the study found that CATI consistently elicited the highest response rate (see Table 1). The IVR does not gain higher response than the Internet. There is some evidence to suggest that these findings may be due to difficulties in using the IVR system. Feedback from census IVR Questionnaire testers revealed that the system was somewhat difficult to use. Moreover, the level of response does not differ between CATI and IVR when calls and rollovers to CATI are permitted from households assigned to IVR, suggesting that usability issues rather than mode preference are responsible for the IVR and CATI difference.

Table 1. Mode Specific Response Rates, Sample Sizes[1], and Response Rate Differences Among Modes and Across Incentive Groups

Mode	Mode Specific Response Rate	Difference**
CATI	**7.8% (1656)**	**2.9%***
IVR	4.8% (1555)	
CATI	7.8% (1656)	**4.1%***
Internet	3.7% (1717)	
IVR	4.8% (1555)	1.2%
Internet	3.7% (1717)	

[1]Undeliverables and late mail returns are excluded from this analysis
* statistically significant when the familywise error rate is controlled using Bonferroni
at α=.1 for all comparisons
** Note that the numbers in the difference column may be slightly different from the
computations using the rates presented due to rounding error.

In order to assess the effect of the incentive within and across response modes, response rates in Table 2 were computed for each experimental treatment along with pairwise differences between the incentive and non-incentive groups within and across each response mode.

Table 2. Mode Specific, Sample Sizes[1], and Pairwise Differences Between Incentive and No Incentive Groups Within and Across Response Modes

Mode	Mode Specific Response Rate		Difference
	Incentive	No incentive	
CATI	8.8% (875)	6.7% (781)	2.1%
IVR	6.4% (753)	3.4% (802)	**3.0%***
Internet	3.9% (867)	3.4% (850)	.5%
Total	6.4%	4.5%	**1.9%***

[1]Undeliverables and late mail returns are excluded from this analysis
* indicates statistical significance when α=.1.

Results in Table 2 show that the incentive increases mode specific response compared to no incentive when rates are computed across response modes. The incentive effect is not significant within CATI and Internet, but is significant in the IVR.

Table 3 presents logistic regression coefficients when the mode specific response rate is regressed on the experimental treatments as well as some control variables. The Simple Model investigates the effect of the incentive on response while controlling for strata (as a proxy for socioeconomic status) under the assumption that the effect is consistent within each response mode. The interaction model reveals whether the incentive effect differs based on the stratum to which it is administered.

Table 3. Logistic Regression Coefficients Predicting the Log Odds of Responding to the Census through the Assigned Mode

Predictor Variables	Simple Model	Incentive-Strata Interaction Model
Mode:		
Internet = 1	**-.302***	.012
CATI = 1	**.496***	**.717***
IVR = 1	--	--
Incentive:		
Incentive = 1	**.374***	**.888***
Census Area (strata):		
High Coverage Area = 1	**.567***	**.725***
Interactions:		
CATI * Incentive		-.365
Internet*Incentive		**-.534***
Incentive*Strata		-.253
Intercept	-3.616	-3.934

* indicates statistical significance when $\alpha = .1$

Tests of parameter estimates in the Simple Model confirm that CATI obtains higher response than the Internet and IVR while controlling for the incentive treatment, and that the incentive effect holds while simultaneously controlling for response mode and stratum.

The Interaction Model in Table 3 helps to determine if the incentive is more effective in increasing response in low coverage areas (high Black and Hispanic and renter concentration) compared to high coverage areas. The test of this interaction (Incentive*High Coverage Area = -.253) indicates that the effect of the incentive on response is not significantly different between high and low coverage areas. This finding contradicts past literature that showed a more pronounced incentive effect among lower socio-economic populations compared to other populations (Kulka,1994; Singer,2002). There are at least two possible reasons for this discrepancy. First, strata, while a good indicator of census response, is based on 1990 tract level data and may not be a suitable proxy variable for socio-economic status. Secondly, legality and sponsorship differences between the U.S. decennial census and surveys may explain this

discrepancy. Certain people, such as illegal immigrants and fugitives, may deliberately avoid the census. If low coverage areas contain a higher concentration of these people than high coverage areas, it is possible that these results reflect that fact that the incentive does not increase response from those who are intentionally avoiding the census.

Finally, logistic regression coefficients in Table 4 allow an assessment of the effect of the incentive on the demographics of respondents. Specifically, this regression model includes all respondents, regardless of their experimental panel assignment, in an attempt to determine which factors are associated with households that performed the prescribed behavior to receive the incentive.

Table 4. Logistic Regression Coefficients Predicting the Log Odds of Receiving the Incentive Among Respondents

Factor	Model
Age of Person 1	**-.015***
Person 1 Black = 1	.239
Person 1 Hispanic = 1	-.030
Renter-occupied Household = 1	.188
High Coverage Area = 1	-.067
Female = 1	.031
Household Size	-.091
Intercept	-.043

* indicates statistical significance when $\alpha = .1$

The model suggests that Person 1 in households receiving the incentive due to alternative response mode participation tends to be younger than Person 1 in households not receiving the incentive. This finding may suggest that the incentive is more attractive to younger persons. Conversely, since the incentive was only activated for those who tried a new response mode, perhaps younger people are more likely to use new technology. It is impossible to control for the effects of mode in this study given that an alternative mode response was required in order for a household to receive the incentive. However, an age comparison of mail and electronic mode respondents reveals that mail respondents are on average older (50.4) than electronic mode respondents (42.1), suggesting that the proposed incentive effect on younger people may be due to more willingness to try a new mode. Otherwise, while controlling for age, sex, and households size there is no evidence to suggest that incentives disproportionately recruit

nonwhites or renters.

In Table 2, the increase in mode specific response due to the incentive is significant when the three response modes are combined, yet the effect of the incentive is insignificant when overall response to the second mailing is considered (see Table 5). This finding suggests that the incentive redirects response to alternative modes, but does not encourage response from those with no intention of responding.

Table 5. Overall Response Rates, Sample Sizes, and Pairwise Differences between Incentive and No Incentive Groups within and across Response Modes

Mode	Mode Specific Response Rate		Difference
	Incentive	No incentive	
CATI	14.4% (875)	14.5% (781)	-.1%
IVR	15.2% (753)	11.9% (802)	**3.3%***
Internet	11.9% (867)	13.2% (850)	-1.3%
Total	13.8%	13.2%	.6%

* indicates statistical significance when α=.1.

4.6 Results from the Internet Usage Survey

Of the respondents contacted for this study, 8.2 percent (6.8 percent in HCA, 8.6 percent in LCA) did not understand or have any knowledge of the concept of the Internet. Interviews with these respondents were terminated as soon as this lack of understanding was revealed since the remaining survey questions probe for reasons the Internet was not used.

Somewhat surprisingly, 62.9 percent of respondents had Internet access at one or more locations even though they responded to the census by mail or phone when given the option of providing census data via the Internet (see Figure 2). After this information was gathered, interviews with respondents who did not have Internet access were terminated.

Figure 2. Internet Access Rates by Coverage Area

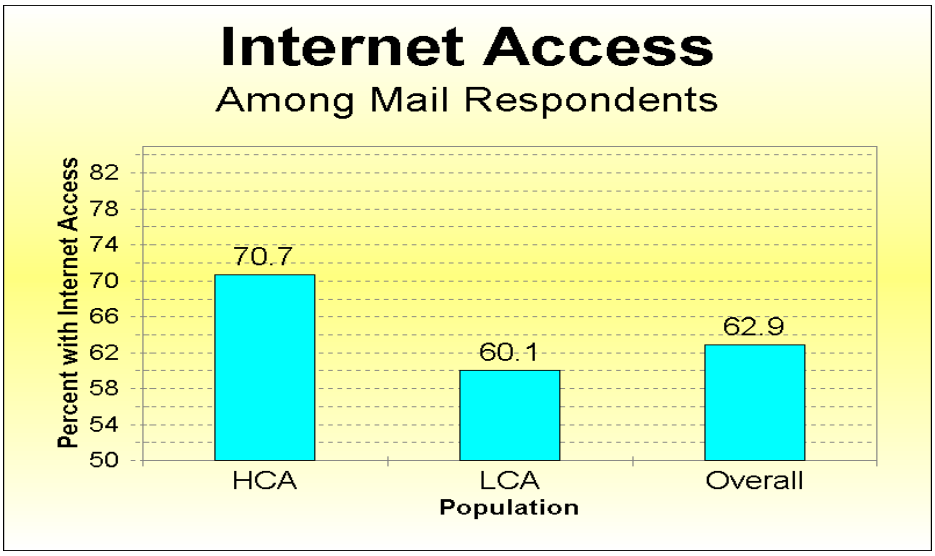


Table 6 provides the percentage of respondents in each stratum and the full sample who had Internet access at various locations.

Table 6. Internet Access Rates by Location

Access to Internet at:	Coverage Area		Overall
	High	Low	
Home	47.0	26.1	31.6
Work	34.9	31.9	32.7
School	16.9	16.7	16.7
Library	46.5	46.4	46.4
Family/Friends	16.2	14.5	15.0
Other*	2.2	3.6	3.3
Any above source	70.7	60.1	62.9

* Other sources include: wherever I go/everywhere, church, neighbors, local businesses/cafes.

A large number of respondents were unaware that the option of replying to the census by the Internet was available. Nearly half (48.2 percent) of respondents who received the calling card as an incentive to use the Internet were unaware of the Internet option, despite the colorful brochure printed on heavy stock paper included in their questionnaire package containing the calling card as well as an announcement of Internet availability. Over half (54.9 percent) of non-incentive respondents reported that they did not know they could have used the Internet to respond.

Table 7 provides data on the reasons respondents with Internet access gave for completing the paper census form rather than the Internet version.

Table 7. Reasons Respondents did not Use the Internet by Coverage Area

Reasons for Not Using the Internet	Coverage Area		Overall
	High	Low	
Easier/Convenient/Prefer Paper	38.8	33.3	35.0
Other*	17.2	23.1	21.3
Don't have access to a computer	12.4	12.8	12.7
Don't have enough Internet experience	18.0	10.3	12.5
Concerned about privacy of answers	10.0	12.8	12.0
Have access to a computer but no Internet	4.4	7.7	6.7
Computer at other location	4.4	5.1	4.9
Don't think the Internet is accurate	0.0	5.1	3.6
Don't like the Internet	1.4	0.0	0.4

* Other reasons include: computer problems, respondent thought form had to be mailed, respondent
did not think about it/realized too late.

Of those who received the incentive in the initial mailing, 57.3 percent claimed that they were unaware of the offer to receive a free calling card. When those who were unaware of the incentive offer or did not receive the offer were asked if they would use the Internet if they were given a 30-minute calling card to do so, 41.2 percent indicated that they would. Those who continued to decline the Internet option were asked if they would use the Internet if the value of the calling card was doubled or tripled. Table 8 summarize the findings from these questions.

Table 8. Percentage of Respondents Not Aware of/Not Offered the Incentive Who Would Use the Internet by Incentive Amount

Amount of Incentive	Coverage		Overall
	High	Low	
60 minute calling card	10.2	8.7	9.2
90 minute calling card	7.1	14.3	11.9

5. RECOMMENDATIONS

5.1 Recommendations Based on the Response Mode and Incentive Experiment

The results of the RMIE can help guide future use of computer-mediated response modes and incentives in the decennial census. The results address the questions:

- Can offering alternate, computer-mediated response modes increase overall response rates?
- Do respondents using alternate, computer-mediated response modes tend to provide good quality data?
- Are the costs involved in offering alternative response modes commensurate with any advantages they offer?

Overall response rates did increase when respondents were offered the CATI and Internet alternative modes, as compared with the control group. The increase in overall response rates was small and occurred only when the respondents were not offered an incentive. When an incentive was offered, overall response rates went down slightly, to about the same level as that of the control group. These alternative response modes also seemed to reduce the amount of missing data for particular items; that is, the item nonresponse rates tended to be higher for mail questionnaires as compared with CATI and Internet questionnaires.

The major drawback to the CATI mode is its cost. CATI involves a number of expenses that the other modes do not require, such as the costs associated with the interviewers, CATI equipment and software, and the 800 telephone line. The interviewer costs are increased by the time that they must spend unoccupied, waiting for calls. However, CATI also involves some cost savings within the context of a large-scale census data collection effort. CATI data

collection saves the costs for return postage and data capture associated with mail surveys. Also, CATI did seem to improve some aspects of data quality; CATI did have less missing data than the mail survey on certain items. However, this difference was not extremely large and probably does not justify the increase in costs that this mode would likely involve.

It is difficult to assess these tradeoffs precisely. However, it is likely that CATI poses a significant increase in cost relative to the current census procedures, unless these costs can be offset by a large increase in the response rate. The RMIE results suggest that offering a CATI response mode alternative does not bring about such a large increase in the response rate.

Like CATI, the Internet mode yielded relatively high data quality. There was also a relatively low rate of missing data on key items. When an incentive and insert were not included, the response rate was approximately one to two percentage points higher than that of the CCG. Relative to the census mail procedure, the costs of fielding a web survey are likely to be relatively modest. The primary additional cost associated with the Internet, relative to mail, involves the development and maintenance of the software and hardware. However, this cost is fixed and does not increase as more data are collected. Web surveys also have lower postage and processing costs than mail surveys do. Data quality could be improved further with the introduction of automated edits.

Based on conservative assumptions and the data from RMIE, one might save between one and six million dollars in postage costs alone if between three percent and 15 percent of the sample uses the web rather than the mail survey. This estimate assumes that the postage to mail back the short form is 37 cents and 110 million households must be enumerated (3 percent x 110 million households x 37 cents postage = $1.2 million; 15 percent x 110 million households x 37 cents = $6.1 million). This savings would more than offset the costs required to design, develop and maintain the web survey. Of course, the web survey would also produce savings related to reduced processing (receipt and scanning). Given this crude calculation, it is anticipated that the Internet would be cost-effective even if a relatively small proportion of respondents used it. Offering a web survey would also provide additional cost savings if it increased the overall response rate, as it did in RMIE, as fewer followup field interviews would be required.

The implications of this experiment for the use of the IVR Questionnaire are complex. Data quality was the lowest for this response mode, both in terms of response rate and missing data items. Much of these missing data were due to individuals hanging up relatively early during the interview. With respect to costs, the IVR system has fixed costs related to purchasing the hardware, developing the software and maintaining the data collection site. There are other costs if operator assistance is provided for those individuals who cannot complete the questionnaire using the IVR system. There are also additional data-processing costs because of the need to transcribe information that the speech recognizer could not code. Therefore, an IVR Questionnaire is more costly than an Internet survey. It is unclear how IVR costs compare to those of CATI or mail questionnaires. An additional issue is whether (and how) to inform respondents that they would be providing their data to a computer. The RMIE mailings did not notify IVR households that the telephone number was for an IVR Questionnaire. Some of the

negative reaction to the IVR Questionnaire may have been avoided if respondents made the call with the expectation that they would be interacting with an automated system.

Another concern revolves around the design of the IVR interview. Several tasks were difficult to complete or took more time than desired with the IVR Questionnaire. This likely affected the quality of the data with this mode. Issues that may have led to problems include: (1) entering a 22-digit ID, (2) reporting and spelling out the names of all persons in the household and (3) reporting race using information printed on the paper questionnaire.

Some of these issues were a function of the special nature of this experiment within Census 2000. For example, shortening the ID may be possible if a crosswalk could be developed between the full 22-digit census number and a shorter number that would be easier to enter. Also, the IVR Questionnaire may become easier to use as the technology of speech recognition becomes more sophisticated. For example, the IVR Questionnaire did not rely on recognizing the responses to every question. The responses to the questions on race and certain other topics were recorded and later transcribed. Improved capabilities to recognize speech, especially words embedded within a sentence (e.g., reports of multiple races), would allow for easier interaction between the respondent and the computer.

The RMIE results show that the inclusion of a calling card with an insert was extremely effective in promoting the use of the alternative response mode. Comparisons between the incentive and no-incentive conditions reveal that the incentive was associated with three to four-fold increases in the rate of using the alternative mode.

At least some portion of this effect is probably attributable to the insert, which drew the respondents' attention to the availability of the alternative mode. The non-incentive condition relied solely on the census cover letter to inform respondents about the availability of the computer-mediated mode. Many respondents in the no-incentive panels probably did not read the letter. The insert, by contrast, prominently called the respondents' attention to the computer-mediated alternative mode. The insert and calling card may account for some of the effects observed in the incentive condition.

However, this increase seemed to come at some cost to the overall response rate with one to two percent *fewer* people responding when an incentive was offered. In both the CATI and Internet conditions, the overall response rates, once factoring in the mail responses, were lower in the incentive panels than in the no-incentive panels. This reduction may be due to the fact that the calling card incentive makes the response task more complicated. If the alternative modes are not available at the time the respondent tries to use them, the respondent may not follow up in all cases to complete the questionnaire at a later time. The one advantage of a mail questionnaire is that it can be filled out the moment the package arrives. Completing a CATI questionnaire requires the use of a telephone and the availability of a CATI operator. A web survey requires access to a computer that has Internet access. If these are not available at the time the respondent attempts to fill out the questionnaire, then some persons may simply never respond.

This result may also be indicative of a relatively weak effect of the calling card as an incentive. In fact, many respondents whose calling cards were activated never used them, suggesting that the calling card may not have been a universally powerful incentive.

With respect to the nonresponse component of the RMIE, an examination of the response mode alternatives reveals that CATI obtains the highest level of response compared to IVR and the Internet. However, it should not be inferred that the people prefer CATI over the Internet for data collection. Internet accessibility limitations among the population in this nonresponse component confound the response rate comparisons among the modes. As Internet access continues to span the United States population, experiments testing the feasibility of this method for census data collection should continue to be tested.

Consistent with past findings, the use of an incentive in this nonresponse component increases response to the alternative modes; however, the effects disappear when total response to the second mailing is examined. Therefore, the incentive in this experiment is successful in transferring response that would have otherwise been obtained by mail to a different mode, but not in recruiting households who would otherwise not respond.

In contrast to past incentive literature, there is no evidence of increased incentive effects within areas of low census coverage (with high proportions of non-whites and renter units) compared to high coverage areas, which may be due to the fact that coverage area is not a good proxy for socio-economic status. Moreover, there is no evidence that incentives are more powerful at increasing response in the absence of an interviewer as a motivator. It is possible that IVR difficulties as well as Internet accessibility issues confound the incentive effect within each mode. Moreover, the interviewer was only a motivating source in keeping the respondent from discontinuing the interview, since the initial contact was respondent-initiated. Perhaps incentives would prove to be most effective in the self-administered modes if the cases assigned to the CATI mode were contacted directly by the interviewer as in a traditional survey setting.

Comparisons of respondent demographics reveal that the incentive seems to attract younger respondents; however, this finding is confounded with the influence of the alternative response mode options. There is some evidence to suggest that younger persons may be influenced by the chance to use a new mode.

5.2 Recommendations for Future Research

Given the success of the insert and incentive to promote the use of an alternative mode to respond to the census, this option should be considered in future research. This research should carefully consider both the role the insert and incentive separately play in the respondent's decision to participate. It would be useful to better understand the relative effects of the calling card incentive and the insert on the respondents' decision to use the alternative

response modes. The use of just an insert, without any incentive, has a number of economical and logistical advantages for the census. Research is needed into the best ways to present the alternatives through either the letter or an insert.

As many respondents interviewed as part of the IUS reported that they were unaware that either an alternative response mode or an incentive was offered, future research should also be directed at how best to convey this information to respondents. It is possible that when the package of materials arrives at the household, one person opens the package, saves what appears to be necessary (the actual form and the return envelope) and throws the rest away. Then, when a member of the household is actually ready to complete the census form he/she no longer has the information explaining these aspects of the data collection process. Perhaps finding a way to provide this information directly on the paper form would further increase the percent of respondents who provide their data through some alternative response mode.

There is also some indication that the calling card incentive may not have been a particularly effective motivator. Only 28 percent of respondents fully used the calling card and a third of respondents never used their cards at all. **While the calling card has the advantage of being usable anywhere in the country (which store gift certificates, for example, would not be), future research should investigate other types of incentives that might be valued by a greater percentage of respondents.**

The incentive and alternative response modes were not effective tools for increasing response among typical census nonrespondents as evidenced by the results of the nonresponse component of the RMIE. The incentive, while somewhat effective in directing response to a particular mode, has no overall effect on total response to the census. Moreover, the response mode comparisons in this study are confounded due to Internet access limitations as well as IVR system technology limitations. Therefore, further testing is needed prior to the 2010 census. Obviously we are likely to see increased access to the Internet in the years to come. With increased access may come an increased acceptance of the use of the Internet for collecting important information such as that collected in the census. Similarly, it is likely that enhancements will continue to be made in the speech recognition software used in the IVR Questionnaire. Future research should continue to monitor the progress of this software. A more "user-friendly" system might increase response rates for this mode as well as reduce the amount of missing data that occurred in this mode.

Finally, future research should seek to gain a more detailed understanding of the costs associated with providing each of the alternative response modes. This knowledge would further inform the decision to provide these alternative modes in the future. In addition, such information would allow researchers to understand the true "cost" of providing an incentive in the census. If the costs associated with mailouts and data processing could be sufficiently reduced by offering an incentive for respondents to provide their data through an alternative response mode, then an incentive might pay for itself.

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